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EFFECTIVE PROTECTION AND THE PROTECTIVE EFFECT

by

© Donald Gilfix

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graudate Studies and Research, for acceptance, a thesis entitled "Effective Protection and the Protective Effect" submitted by Donald Gilfix in partial fulfilment of the requirements for the degree of Master of Arts.

J. Tomkins
Supervisor

Date January 3, 1974.

ABSTRACT

The original theory of effective protection, developed under the assumption of zero elasticity of substitution between inputs, has proven to yield an inaccurate measure of the effective rate of protection. This paper first presents a measure of the effective rate when substitution is allowed to take place, and then after showing why this measure is still biased develops an alternative and less biased formula for measurement using the profit-maximizing conditions of the firm.

There has been a great deal of confusion surrounding the fact that while the effective rate gives the rate of protection granted to the primary factors by the tariff structure, it does not directly show the changes in domestic production resulting from this tariff structure. This paper does separate these two concepts and analyzes the change in output, the 'protective effect'. The profit-maximizing model is then presented and compared for the cases of constant and decreasing returns to scale. At this point it is again noted how the confusion between the effective rate of protection and the protective effect have caused a misunderstanding of the concept of effective protection. Finally, there is a discussion of how an understanding of the theory of effective protection can be used as an aid in government policy decisions.

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CHAPTER I

INTRODUCTION

The concept of effective protection was first introduced in 1955 by Clarence Barber.[1] The imposition of a tariff on the final output of an industry grants protection to a producer in that it allows him to raise the domestic selling price and therefore continue to remain competitive with imports that have a lower international, or 'free trade' price. However, unless the intermediate inputs of this final good consist entirely of non-traded goods, there will potentially be tariffs applied to these intermediate inputs. If this is the case then the producer will have to pay more for his intermediate inputs, namely the foreign price plus the tariff, thereby raising the costs of production. The "effective protection" enjoyed by the producer is, therefore, the net effect of the nominal tariff structure, taking into account both the price that a producer can charge for his output domestically and the domestic prices that must be paid for the intermediate inputs.

Since Professor Barber's original article, there has been a great deal written about the concept of effective protection. However, this writing has, for the most part, concerned itself with theoretical matters such as the proper

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[1] Barber, C. L., "Canadian Tariff Policy", The Canadian Journal of Economics and Political Science, November 1955, pp. 523-524.

measurement for the effective rate, or with empirical studies comparing the effective rate with the nominal rate. What appears to have been neglected in the aforementioned works is possibly the most important property of the effective rate of protection. That is, by using the effective rate of protection we are better able to see the effects of tariffs on resource allocation.

One of the most widely asked questions concerning the effective rate is whether or not its use will aid in predicting the flow of resources. That is, will an industry which has a higher effective rate of protection necessarily expand its output more than an industry with a lower effective rate, thereby drawing resources from the second industry? However, the rate of effective protection is not to be confused with the protection actually granted to an industry in the way of increased output; the latter is known as the 'protective effect' of a tariff structure. This distinction is extremely important, because, while the effective rate depends only on the tariff structure the protective effect depends also on the domestic supply curve.

This thesis will first present an analysis of the fixed-input coefficient case of the theory of effective protection. The assumptions surrounding this fixed-input coefficient case will then be discussed and, in turn, the theory modified to allow for substitution between the inputs. In Chapter II we will note the existing deficiencies in the

current measurement of the effective rate of protection and will present a new measure of the effective rate to correct these deficiencies.

In order to properly understand the differences between the effective rate of protection and the protective effect, Chapter III will first present a definition of the protective effect and then a geometric analysis of these relationships. We will then view this effect with respect to the profit-maximization conditions of the firm.

Having discussed the theoretical aspects of the two concepts, it will now be necessary to explore how these theoretical tools may be of use in the 'real world'. This will be done in Chapter IV. Finally, Chapter V will discuss the conclusions reached in this thesis and suggest needs for future research.

Chapter II

MEASURING THE EFFECTIVE RATE OF PROTECTION

Over a period of the last few years the topic of 'effective' protection has been the center of considerable attention, both theoretically and empirically, among international trade economists. The original theory was developed under the assumption that there are fixed coefficients between the inputs used in production, so that the coefficients are the same under free trade and protection. Recently this assumption of fixed ccefficients has been questioned. This chapter will first present a survey of the theory of effective protection developed under the assumption of fixed input coefficients. We will then seek to clarify and extend the discussion in the tradition of partial equilibrium with factor substitution. That portion of this chapter will first introduce and develop a formula for the effective rate when we allow for substitution and then present a modified form of this formula using the profit-maximizing conditions of the firm.

2.1 The Case of Fixed Coefficients

The most widely used of the early definitions given prominence by Corden, Johnson and others[1] was:

[1] Corden, W. M., "The Structure of a Tariff System and the Effective Protection Rate", JPE, 74 (1966), pp. 221-237 and Johnson, H. G., "The Theory of Tariff Structure with Special Reference to World Trade and Development", Trade and Development, Geneva: Institut des Hautes Etudes Internationales (1965).

"The effective rate of protection is the percentage increase in value added per unit in an economic activity which is made possible by the tariff structure relative to the situation in the absence of tariffs but with the same exchange rate."[2/] Later this definition was found to be inadequate and a definition used by Leith was adopted which defines the effective rate as the proportionate change in the price of the primary input ('effective price' or price of the value-added product) made possible by the tariff structure and other trade taxes and subsidies relative to a situation where the same exchange rate holds but where tariffs, trade taxes and subsidies are absent.[3/] Although these two definitions do differ when substitution between primary factors and (importable) intermediate products is introduced, they both give the same results when the case is one of fixed coefficients. Either implicitly or explicitly the initial writers made the following assumptions:

(a) The foreign price of each importable is taken as being the free trade price so that the tariff represents the rate of divergence between the free trade and the protected price of a tradable.

(b) The production function relating to the tradable and the primary inputs is linearly homogeneous.

2/ Corden, ibid.

3/ Leith, J. C., "Substitution and Supply Elasticities in Calculating the Effective Protection Rate", QJE, 82 (1968), pp. 588-601.

(c) The elasticity of substitution between the inputs is zero so that the physical input-output coefficients are all fixed.

(d) The elasticities of demand for all exports and supply of all imports are infinite.

(e) Appropriate fiscal and monetary policies maintain total expenditure equal to full employment income.[4/]

(f) Trade and production, in protected industries, continue even after tariffs and taxes have been imposed.

Under these assumptions it is possible to derive the formula for the effective protective rate for the activity producing j, where j is one particular industry, and where;

v_j = the value-added product, the share of j which is produced by varying proportions of the primary factors, at free trade prices,[5/]

[4/] This assumption made by Corden, op. cit., p. 222. Leith op. cit., p. 589, allows for the elasticity of supply of the domestic non-tradable goods to be infinite, but for the supply of factor inputs to the domestic industry to be less than infinite.

[5/] The value-added product, $(1-\sum_{i=1}^{m} a_{ij})$, may be produced by varying proportions of primary factors even though the same value-added product as a proportion of total output is retained, the different combinations of primary factors being such to produce the same value-added product.

v'_j = the value-added product, after tariffs, taxes, and subsidies have been imposed,

P_{v_j} = the free trade effective price, the price of the value-added product,

$P_{v'_j}$ = the effective price after the tariffs, taxes, and subsidies have been imposed,

g_j = the effective rate of protection for production of the j^{th} good,

a_{ij} = the share of the input from industry i in cost of a unit of j, at free trade prices,

a'_{ij} = the share of i in cost of a unit of j after tariffs, taxes and subsidies have been imposed,

$\bar{t}_j$ = the tariff rate on imports of good j,[6] and,

$\bar{t}_i$ = the tariff rate on good i, the importable input.

Then $$P_{v_j} = P_j(1-\sum_{i=1}^{m} a_{ij}),[7] \qquad (1)$$

---

[6] The tariff rate is assumed to be the total of all tariffs, taxes and subsidies; the separate effects of each will be discussed later in the chapter.

[7] Where m is the number of importable intermediate inputs. It is implicitly assumed that all inputs are importable though not necessarily imported.

$$P_{v_j'} = P_j[(1+\bar{t}_j) - \sum_{i=1}^{m} a_{ij}(1+\bar{t}_i)], \tag{2}$$

$$g_j = \frac{P_{v_j'} - P_{v_j}}{P_{v_j}} = \frac{P_{v_j'}}{P_{v_j}} - 1. \tag{3}$$

From equations (1), (2), and (3),

$$g_j = \frac{\bar{t}_j - \sum_{i=1}^{m} a_{ij}\bar{t}_i}{1 - \sum_{i=1}^{m} a_{ij}}, \tag{4}$$

in terms of free trade coefficients, and

$$g_j = \frac{1 - \sum_{i=1}^{m} a'_{ij}}{\frac{1}{(1+\bar{t}_j)} - \sum_{i=1}^{m} \frac{a'_{ij}}{(1+\bar{t}_i)}} - 1, \tag{5}$$

in terms of protection coefficients, where;

$$a'_{ij} = a_{ij}\frac{(1+\bar{t}_i)}{(1+\bar{t}_j)}, \tag{6}$$

is the share of the importable input in the cost of output under protection.

Equation (4) can be rewritten as:

$$g_j = \frac{\bar{t}_j}{1 - \sum_{i=1}^{m} a_{ij}} - \frac{\sum_{i=1}^{m} a_{ij}\bar{t}_i}{1 - \sum_{i=1}^{m} a_{ij}}, \tag{4.1}$$

or as

$$g_j = \bar{t}_j + \frac{\sum_{i=1}^{m} a_{ij}}{1 - \sum_{i=1}^{m} a_{ij}}(\bar{t}_j - \bar{t}_i), \tag{4.2}$$

or as

$$\bar{t}_j = (1-\sum_{i=1}^{m} a_{ij})g_j + \sum_{i=1}^{m} a_{ij}\bar{t}_i \quad . \tag{4.3}$$

Alternatively, equation (5) may be written as:

$$g_j = \frac{\dfrac{\bar{t}_j}{(1+\bar{t}_j)} - \sum_{i=1}^{m} \dfrac{a'_{ij}\bar{t}_i}{(1+\bar{t}_i)}}{\dfrac{1}{(1+\bar{t}_j)} - \sum_{i=1}^{m} \dfrac{a'_{ij}}{(1+\bar{t}_i)}} \quad . \tag{5.1}$$

It is now possible to interpret the preceeding notation. Equation (4) shows that the effective rate, g_j, depends on the nominal output tariff, $\bar{t}_j$, and on the nominal input tariff, $\bar{t}_i$, and on the free trade input share, a_{ij}. The subsidy element, $\bar{t}_j/(1-\sum_{i=1}^{m} a_{ij})$, is the proportional increase in the effective price afforded by the imposition of a tariff on j. The tax element, $a_{ij}\bar{t}_i/(1-\sum_{i=1}^{m} a_{ij})$, is the proportional fall in the effective rate resulting from the imposition of a tariff on the (importable) intermediate input, i. Equation (4.2) shows that the effective rate is equal to its nominal rate plus or minus an amount which depends on its input share and on the excess of the nominal tariff on the input (or the extent to which the nominal rate on j falls below the nominal rate on i). Equation (4.3) shows that the nominal tariff rate on the final good is a weighted average of its own effective rate and the tariff rate on its inputs. Equation (5) is an expression for the effective rate formula in terms of share of inputs under

protection. It is this share which input-output coefficients normally reveal, not the share that would exist if there were free trade. Equation (5) is simpler and yields the formula which has been used by many researchers,[8] while (5.1) is analytically more meaningful since it brings out clearly the deflated nature of this relation compared to (4).

The implications of the formula, (4), for the effective rate can be summarized as follows:[9]

$$\text{If } \bar{t}_j = \bar{t}_i, \text{ then } g_j = \bar{t}_j = \bar{t}_i. \qquad \text{(i)}$$

$$\text{If } \bar{t}_j > \bar{t}_i, \text{ then } g_j > \bar{t}_j > \bar{t}_i. \qquad \text{(ii)}$$

$$\text{If } \bar{t}_j < \bar{t}_i, \text{ then } g_j < \bar{t}_j < \bar{t}_i. \qquad \text{(iii)}$$

$$\text{If } \bar{t}_j < \sum_{i=1}^{m} a_{ij}\bar{t}_i, \text{ then } g_j < 0. \qquad \text{(iv)}$$

$$\text{If } \bar{t}_j = 0, \text{ then } g_j = -\frac{\sum_{i=1}^{m} a_{ij}\bar{t}_i}{1-\sum_{i=1}^{m} a_{ij}}. \qquad \text{(v)}$$

$$\text{If } \bar{t}_i = 0, \text{ then } g_j = \frac{\bar{t}_j}{1-\sum_{i=1}^{m} a_{ij}}. \qquad \text{(vi)}$$

8/ Studies in B. Balassa (ed.), The Structure of Protection in Developing Countries (1971); G. Basevi, "The United States Tariff Structure: Estimates of Effective Rates of Protection of United States Industries and Industrial Labor", Review of Economics and Statistics, 48(1966), pp. 147-160.

9/ Corden, Theory of Protection, op. cit.

$$\frac{\partial g_j}{\partial \bar{t}_j} = \frac{1}{1-\sum_{i=1}^{m} a_{ij}}, \qquad \text{(vii)}$$

$$\frac{\partial g_j}{\partial \bar{t}_i} = -\frac{a_{ij}}{1-\sum_{i=1}^{m} a_{ij}}, \qquad \text{(viii)}$$

$$\frac{\partial g_j}{\partial a_{ij}} = \frac{\bar{t}_j - \bar{t}_i}{\left(1-\sum_{i=1}^{m} a_{ij}\right)^2}. \qquad \text{(ix)}$$

Implication (i) shows that if the nominal tariff rate on the output is equal to the nominal tariff rate on the input, then this will also be equal to the effective protective rate. It is important to note that this refers to tariff 'rates' and not to the absolute tariffs per unit; if these were equal the effective rate would be zero. Implication (ii) shows that if the nominal tariff rate on the output is higher than the nominal tariff rate on the input, the effective protective rate will be higher than the nominal tariff on the output, while implication (iii) shows that if the nominal tariff rate on the input is higher then the opposite will hold. Implications (iv) and (v) state that the effective rate of protection can be zero if $\bar{t}_j = \sum_{i=1}^{m} a_{ij}\bar{t}_i$, or negative if the tariff rate on the inputs is sufficiently higher than the tariff rate on the output, or if there is no tariff on the output. Implication (vi) states that when the nominal tariff rate on an input is

zero then the effective rate of protection will be higher, the higher the share of the intermediate input in total cost, for any given nominal tariff rate on the output. If the input share, $\sum_{i=1}^{m} a_{ij}$, is high then the effective rate will be quite sensitive to changes in the nominal rate on the output. Implications (vii) and (viii) show the effective rate variations in response to changes in output and input nominal rates. Implication (ix) shows that whether a rise in the input share raises or lowers the effective rate depends on the difference between the output and input nominal rates.

The model that we are using assumes only one (importable) intermediate input, however, it is possible to extend the analysis for several inportable inputs, but no non-traded or exportable inputs, by considering them as a composite commodity with an input share b_j, where $b_j = \sum_{i=1}^{m} a_{ij}$, and m is the number of (importable) intermediate inputs. In this case, $\bar{t}_i$ is used as the weighted average of the input tariffs, but may be considered as a single tariff associated with the composite commodity.

It must be remembered that not only nominal tariff rates have an effect on the rate of protection granted an industry; it is possible to separate the effects of tariffs from the effects of production or consumption taxes or

subsidies. This procedure can be shown where[10/]

t_j = the nominal tariff rate on j, defined now not to include any production taxes or subsidies;

t_i = the nominal tariff rate on i, defined now not to include any production or consumption taxes or subsidies;

c_j = the consumption tax rate on j (which may be a production tax combined with a border tax at an equal rate); it is expressed as a proportion of the price including the tariff;

c_i = the consumption tax rate in i, defined as for c_j, where $i \neq j$;

a_{ij} = the share of i in the cost of j, valuing at free trade prices and with no consumption taxes or subsidies;

a'_{ij} = the share of i in cost of j, valuing at domestic market prices after both tariffs and consumption taxes have been imposed, that is, at consumer prices and not at producer prices; and,

s_j = the production subsidy on j.

10/ This section draws heavily on Corden, W. M., Theory of Protection, Oxford University Press: London, 1971, pp. 40-42.

The consumption tax on j does not influence effective protection of j. However, the production subsidy on j raises the nominal protection granted to it. Therefore, allowing for the protecive effect on j of s_j, and for the tax effect on j of c_i, rewrite (4) as

$$g_j = \frac{t_j + s_j(1+t_j) - a_{ij}[\, t_i + c_i(1+t_i)]}{1-a_{ij}} . \qquad (6)$$

The share of the i^{th} input in cost of j, under protection, a'_{ij}, can be rewritten allowing for the effect of c_i in raising the domestic price of i, and c_j in raising the price of j as:

$$a'_{ij} = a_{ij}\frac{(1+t_i)\ (1+c_i)}{(1+t_j)\ (1+c_j)} . \qquad (7)$$

In equation (7) it is the consumption tax on j, not the production subsidy, which has a role since the market price of j (on which the input share a'_{ij} is assumed to be based here) is affected by the consumption tax but not by the production subsidy. From (6) and (7)

$$g_j = \frac{\frac{1+s_j}{1+c_j} - a'_{ij}}{\frac{1}{(1+t_j)\ (1+c_j)} - \frac{a'_{ij}}{(1+t_i)\ (1+c_i)}} - 1. \qquad (8)$$

A consumption tax is equivalent to a production tax with a nominal tariff at the same rate in that it affects only the pattern of consumption and not production

and hence does not affect the degree of protection. A production subsidy on j would have the same effect on production as a nominal tariff at the same rate, while a production tax would have an effect equivalent to an import subsidy. A similar argument follows for production and consumption taxes and subsidies on input.[11] If the concern were to be merely with the protection of inputs themselves, the previous analysis, with respect to output, will hold. However, if the concern is with the effective protection of industry j, then in this case it will be the consumption taxes on i which will be relevant. A consumption tax on an input has the same effect as a nominal tariff on that input and therefore serves to reduce the effective rate of protection for j. Thus can be seen the need for rewriting equation (4) in the form of equation (6).

The fixed-input coefficient measure of the effective rate assumes that the elasticity of substitution between the input is zero. However, while it may be the case the substitution is limited, it is nevertheless possible. This is the subject of the next section.

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[11] Leith, J. C., op. cit., points out that excess complication results if we were to allow for tariffs on inputs used in the production of non-traded goods. "Such tariffs tax the users of nontraded inputs in the same manner (but not in the same magnitude) as a tariff on a direct material input."

2.2 Substitution and the Effective Rate of Protection

By allowing for substitution between (importable) intermediate inputs and domestic factors, alternative definitions of the effective rate of protection (ERP) may be used depending on the technology used to evaluate it. Corden, (1971), has provided a measure of effective protective rates that may predict resource movements, provided the special assumptions regarding the nature of substitution are adhered to.[12/] The substitution effects must be 'unbiased', a limitation which will be discussed later in this chapter. However, it must be made clear that the "effective rate of protection" does not mean "protective effect". The protective effect is the proportionate increase in domestic supply as a result of tariff changes. The supply increase depends not only on the effective rate but in addition depends on the elasticity of supply over the relevant range; that is, the higher the elasticity the greater the protective effect of a given rate of protection. Elasticity of supply for output is determined by the production function and the supply elasticities of the inputs. Evaluation of the protective effect must obviously start from the fundamental decision-making process of the firm.

12/ Corden, W. M., "The Substitution Problem in Effective Protection", Journal of International Economics, 1 (1971, pp. 37-57.

An attempt to analyze tariff changes according to a profit-maximizing model has been made by Kreinin, et al.[13] However, the results of Kreinin's model are greatly dependent upon the assumption of decreasing returns to scale, while most other models, including Corden's, assume constant returns to scale. We will first analyze the effective rate and the protective effect according to the existing theory using constant returns to scale. In section 3.2 of the next chapter we will allow for decreasing returns to scale and compare the two models.

Now introduce substitution among the inputs and see how the Corden measure for the effective rate of protection differs. The model we present here differs from the one which is normally used in that there is one (importable) final good (Q) produced by one (importable) produced input (X) and only one primary factor, labour (L). The case where the 'value-added product' is produced by varying proportions of primary factors, capital (K) and labour (L), presents several additional problems and will be discussed later in this chapter. There is a twice differentiable linearly homogeneous production function with positive marginal products and a diminishing marginal rate of substitution. The case is one of perfect competition so that the factor prices

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[13] Kreinin, M. E., Ramsay, J. B., and Kmenta, J., "Factor Substitution and Effective Protection Reconsidered", AER, December 1971, pp. 891-900.

are equal to the value of their marginal products.

To derive the exact expressions for the effective rate of protection, assume that production in the industry producing Q is determined by the two-input CES production function:

$$q = \gamma(\delta_1 x^{-\rho} + \delta_2 \ell^{-\rho})^{-1/\rho} , \qquad (2.1)$$

where for each firm q is output, and x and ℓ are the quantities of the imported and labour inputs, respectively. The level of industry output Q and inputs X and L are, $Q = nq$, $X = nx$, $L = n\ell$, where n is the number of firms. Although there is perfect competition in the product market, thus giving a horizontal supply curve, this does not mean there will be a perfectly elastic supply of labour at a certain wage rate, w_o. The supply curve of a labour force is upward sloping, and therefore there will be a finite amount of labour supplied at any given wage rate. The model has been formulated in such a way that the effective rate of protection is the protection granted to labour. This upward sloping supply curve will therefore ensure an upward sloping supply curve for the increasing cost industry. The third chapter discusses the changes in output which are possible as a result of this increased protection. In this form of the CES production function the partial elasticity of substitution between x and ℓ is defined by $\sigma = 1/(1+\rho)$, where ρ is the substitution parameter. We may use the following

equations in order to develop the cost function, C(q):

$$q = \gamma(\delta_1 x^{-\rho} + \delta_2 \ell^{-\rho})^{-1/\rho},$$

$$C = rx + w\ell ,$$

so that cost is a function of output rather than input prices. This is a long-run cost equation so that the formula for the expansion path may be written as

$$\frac{r}{f_1} = \frac{w}{f_2} ,$$

where f_1 and f_2 are the marginal-physical products of x and ℓ respectively. From this information we may calculate the cost functions as

$$C = \gamma(\delta_1^{\sigma} r^{1-\sigma} + \delta_2^{\sigma} w^{1-\sigma})^{1/1-\sigma} \; q ,$$

and from this we get the marginal cost of q,

$$P = MC = AC = \frac{\partial C}{\partial q} = \gamma(\delta_1^{\sigma} r^{1-\sigma} + \delta_2^{\sigma} w^{1-\sigma})^{1/1-\sigma} , \quad (2.2)$$

where P, the price of the final product, is equal to marginal cost under the profit-maximizing conditions of perfect competition. The price of labour is given as w and the price of the (importable) input is given as r. These prices may be restated as $P = P_o(1+t)$, where t is the tariff on the output, and $r = r_o(1+m)$, where m is the tariff on the input. Equation (2.2) can now be solved for the price of the primary input, w:

$$w = \delta_2^{-\sigma/1-\sigma}[\gamma^{\sigma-1} p_o^{1-\sigma}(1-h_o)]^{1/1-\sigma} , \qquad (2.3)$$

where

$$h_o = \frac{\delta^{\sigma} r_o^{1-\sigma}}{\delta_1^{\sigma} r_o^{1-\sigma} + \delta_2^{\sigma} w^{1-\sigma}} ,$$

so that h_o is the ratio of import cost to unit cost, in the free trade situation, and $0 < h_o < 1$ by definition.

Now introduce tariffs. The effective rate (g_ℓ) is taken to be the proportional increase in the effective price, w. The ad valorem output tariff (t) raises P, where $t = \Delta P/P$, and the ad valorem tariff on the input (m) raises r, where $m = \Delta r/r$. Assume that t is greater than m. This means that more x is utilized so that μ_x, the marginal-physical product of x, falls and hence r/P falls (i.e., $r = VMP_x = P \cdot MPP_x$, so $r/P = MPP_x$). The fall in μ_x must be associated with a corresponding rise in the marginal-physical product of ℓ, μ_ℓ (see figure 1). But a rise in μ_ℓ, (less labour is utilized), must imply that $\Delta w/w$ is greater than $\Delta P/P$. Therefore, it follows that in this case $g > t > m$, which is the same result that would be expected from the fixed coefficient formula for the effective rate. This result may be made somewhat clearer by deriving the formula for effective protection.

The price of the primary input, after the imposition of tariffs becomes:

$$w' = \delta_2^{\frac{-\sigma}{1-\sigma}} \left[\gamma^{\sigma-1} P_o^{1-\sigma}[(1+t)^{1-\sigma} - h_o(1+m)^{1-\sigma}]\right]^{\frac{1}{1-\sigma}} , \qquad (2.4)$$

in terms of free trade coefficients. The effective rate of protection is defined as:

$$g_\ell = \frac{w'}{w} - 1 . \qquad (2.5)$$

Substituting equations (2.3) and (2.4) into equation (2.5), the effective rate with substitution is:

$$g_\ell = \left[\frac{(1+t)^{1-\sigma} - h_o(1+m)^{1-\sigma}}{1-h_o}\right]^{\frac{1}{1-\sigma}} - 1 , \qquad (2.6)$$

in terms of free trade coefficients. When t = m, equation (2.6) may be rewritten:

$$g_\ell = \left[\frac{1-h_o}{1-h_o}\right]^{\frac{1}{1-\sigma}} \quad (1+t) - 1 = t , \qquad (2.7)$$

so that $g_\ell = t = m$, regardless of the elasticity of substitution. Table I gives the results obtained when using equation (2.6) for the effective rate of protection. The results for equation (2.7) are verified. The results which were expected, for the implications of the last section, for the fixed-coefficient case, are also verified. It may easily be seen that the effective rate increases as the elasticity of substitution increases. This serves to show that the use of fixed coefficients will necessarily underestimate the effective rate when the elasticity of

TABLE I

Values of the Effective Rate of Protection for Various Choices of Input Substitution and Nominal Output Tariff Rates[1/]

t \ σ	0	.10	.50	.75	1.0	1.5	2.0	5.0	10.0
0	-.200	-.196	-.182	-.173	-.162	-.154	-.143	-.098	-.064
.05	-.100	-.094	-.090	-.085	-.080	-.073	-.067	-.035	-.010
.10	0.000	.001	.004	.006	.008	.012	.015	.034	.048
.20	.200	.200	.200	.200	.200	.200	.200	.200	.200
.30	.400	.401	.404	.406	.409	.414	.418	.481	*
.40	.600	.602	.614	.623	.635	.655	.680	*	*
.50	.800	.807	.834	.854	.881	.929	1.001	*	*

[1/] Calculated under the assumption that h_o = .50 and m = .20.

* Because of the properties of the CES production function this is a limiting case where the isoquants touch the axis.

TABLE II

Values of the Effective Rate of Protection for Various Choices of Input Substitution, Input Share in Total Cost, and Nominal Input Tariff Rates[1/]

	h_o=.10		h_o=.20		h_o=.50		h_o=.75	
σ	m=.10	m=.30	m=.10	m=.30	m=.10	m=.30	m=.10	m=.30
0	.211	.189	.225	.175	.300	.100	.500	-.100
.10	.211	.189	.225	.175	.301	.101	.505	-.095
.50	.211	.189	.226	.176	.304	.104	.526	-.076
.75	.211	.189	.226	.176	.306	.106	.540	-.066
1.00	.212	.189	.226	.176	.310	.108	.561	-.056
1.50	.212	.190	.227	.177	.314	.111	.598	-.040
2.00	.212	.190	.228	.178	.320	.114	.650	-.025
5.00	.214	.191	.233	.180	.373	.130	*	.032
10.00	.233	.193	.248	.184	*	.146	*	.082

[1/] Calculated under the assumption that t = .20.

* Because of the properties of the CES production function this is a limiting case where the isoquants touch the axis.

TABLE III

Value of the Output Tariff Necessary to Achieve a Specified Effective Rate of Protection for Various Choices of Input Protection, Input Share in Total Cost, and Nominal Input Tariff Rates[1/]

	h_o=.10		h_o=.20		h_o=.50		h_o=.75	
σ	m=.10	m=.20	m=.10	m=.20	m=.10	m=.30	m=.10	m=.30
0	.460	.480	.420	.460	.300	.400	.200	.350
.10	.460	.480	.419	.460	.299	.400	.199	.350
.50	.457	.479	.415	.459	.292	.398	.194	.349
.75	.456	.479	.413	.458	.288	.397	.191	.348
1.00	.455	.479	.409	.457	.284	.396	.188	.347
1.50	.451	.478	.404	.457	.277	.395	.183	.346
2.00	.488	.476	.398	.455	.269	.393	.177	.345
5.00	.420	.472	.357	.447	.228	.382	.155	.338
10.00	.353	.461	.284	.431	.180	.367	.133	.329

[1/] Calculated under the assumption that the effective rate of protection, g_ℓ, =.50.

substitution is not equal to zero. Table II shows that the effective rate is directly related to h_o, the share of import cost in total cost, when $t > m$. If it was desired to provide the same effective rates to two products, then Table III shows what nominal tariff rate on the output would achieve this result. For example, if one product were to have a nominal input tariff of .10 and an import cost share of .20 while another had $m = .30$ and $h_o = .50$, then a tariff of $t = .23$ for the first product and $t = .11$ for the second would equate the two effective rates. This is under the assumption of elasticities of substitution being the same in both industries.

So far the analysis has been carried out in terms of free trade data. This expression for the effective rate can be converted readily into an expression in terms of the data obtainable after the tariffs have been imposed. The most commonly used formula for the effective rate, using protection data, makes use of the following relationship between free trade and protected trade shares:[14/]

$$h'_o = h_o\left[\frac{1+m}{1+t}\right]^{1-\sigma} . \qquad (2.8)$$

Substituting equation (2.8) into equation (2.6), the protected trade expression becomes:

[14/] The relationship was given in this form by Grubel, H. G., and Lloyd, P. J., "Factor Substitution and Effective Tariff Rates", Review of Economic Studies, January 1971.

$$g_{\ell} = \left[\frac{1-h'_o}{1-h'_o\left(\frac{1+t}{1+m}\right)^{1-\sigma}}\right]^{\frac{1}{1-\sigma}} (1+t) - 1 \ . \qquad (2.9)$$

It was stated in the previous section that if the only data obtainable after the tariffs have been imposed is used when there is substitution, this will necessarily lead to an overstatement, while use of the free trade data will lead to an understatement. Corden has given an excellent graphical interpretation of why this occurs.[15/] His results may be summed up briefly in Figure 1. The marginal-physical product of x, μ_x, is shown along the horizontal axis and the marginal-physical product of ℓ, μ_ℓ, along the vertical axis. Due to homogeneity of degree one property of the production function, we will have a concave curve towards the origin in the factor price fields. The slope of this curve, FF', at any point $(d\mu_x/d\mu_\ell)$ is equal to the negative of the factor ratio, x/ℓ, associated with that point.

Somewhere between R and R' on FF' is a point R* which has the same slope as the straight line RR'. It is this point that will give the μ_x and μ_ℓ associated with the the equilibrium supply of q. There is a certain factor ratio x^*/ℓ^* associated with the equilibrium supply of q. If the protection situation data were used then this would result in a higher factor ratio than x^*/ℓ^* which will

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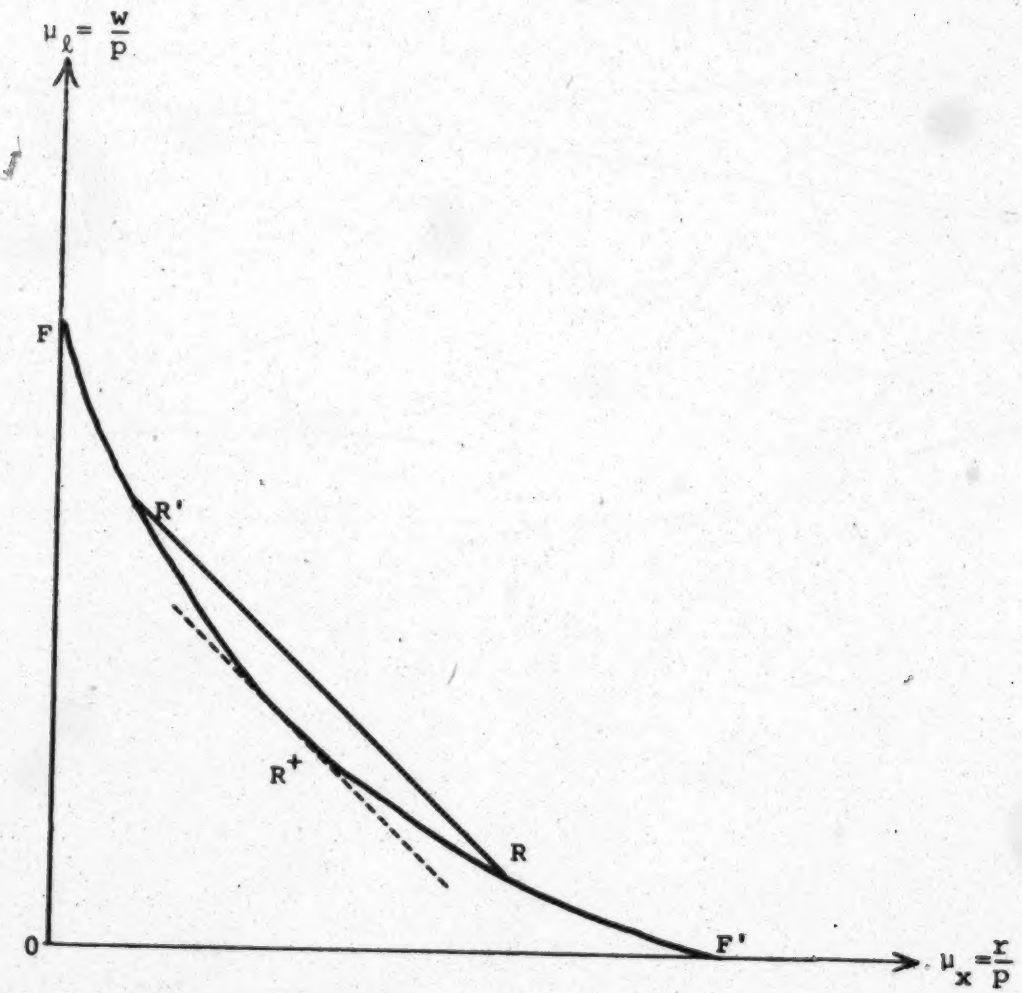
[15/] Corden, op. cit., pp. 38-50.

Figure 1



Relationship Between the Marginal-Physical Products of the Inputs

necessarily result in an overstatement of h*, the input share at free prices. This rests on the assumption that $t > m$, so that g_ℓ will be overstated. Use of the free trade data will mean using a factor ratio lower than x^*/ℓ^*, so that h* will be understated, and when $t > m$, this means that g_ℓ will be understated. If the effective rate is negative, the conclusion must be interpreted as meaning that substitution causes the effective rate to fall less than it would with fixed coefficients. This fall will be understated by using the protection situation data, possibly even to the extent of yielding a measured rate that is positive.

Where Corden and others have correctly diagnosed the problem of using either free trade or protection data, they have not presented an alternative measure of the input share so that the effective rate may be correctly measured. In order to achieve this correct measure it is necessary to start from the basic profit-maximizing conditions of production. That is, output will be supplied up to the point where price is equal to marginal cost. With this in mind the share of the imported input in unit cost may be derived as in equation (2.3), by letting:

$$h_o = \left[\frac{\delta_1^\sigma \, r_o^{1-\sigma}}{\delta_1^\sigma \, r_o^{1-\sigma} + \delta_2^\sigma \, w^{1-\sigma}} \right],$$

and

$$h'_o = \left[\frac{\delta_1^\sigma \, r_o^{1-\sigma} \, (1+m)^{1-\sigma}}{\delta_1^\sigma \, r_o^{1-\sigma} \, (1+m)^{1-\sigma} + \delta_2^\sigma \, w^{1-\sigma}} \right] = h_o b,$$

and

$$b = \left[\frac{(1+m)^{1-\sigma}}{(1+m)^{1-\sigma} \, h_o + (1-h_o)} \right],$$

and

$$(1-h_o) = \frac{\delta_2^\sigma \, w^{1-\sigma}}{\delta_1^\sigma \, r_o^{1-\sigma} + \delta_2^\sigma \, w^{1-\sigma}} .$$

This input share, h'_o, will be less than that given by the protection data, but greater than that given by the free trade data. It is now possible to modify the effective rate to be

$$g_i^* = \left[\frac{(1+t)^{1-\sigma} - h_o b}{1-h_o} \right]^{\frac{1}{1-\sigma}} - 1 .$$

This formula will better estimate the effective rate.

As was mentioned earlier in this chapter, the model used here differs from that used by Corden in that it employs only one primary factor. Corden's model uses two primary factors, capital (K) and labour (L), making up the "...'value-added product' which can be produced by varying proportions of primary factors...".[16] But what is a unit

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[16] Corden, op. cit., p. 49.

of 'value-added product', v? When there are fixed coefficients between x and a unit of output, then v is simply the output q minus the input x. All those combinations of L and K which are just sufficient to produce one unit of output, when associated with the fixed amount x, represent one unit of v. Once substitution is introduced, the ratio of v to final output changes when relative prices change. Since v cannot then be defined in terms of units of the final product, a problem arises since v has no "natural units". Corden makes the following assumption: "The ratio between the primary factors in industry j, that is, the L/K ratio, will change only if the price ratio L and K alters, and the ratio between the produced input x and the final good j, that is the input coefficient x/j, will alter only if the price ratio between these two alters.... We can define v in this case as a bundle of L and K containing the two factors in fixed proportions."[17/]

Corden makes the further assumption of 'unbiased' substitution effects, where Corden defines 'unbiased' to mean that the elasticity of substitution of x for ℓ is the same as the elasticity of substitution for capital, k, where $n\bar{k} = \bar{K}$.

Complications result if x is a much closer substitute for one primary factor than for another. For

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17/ Ibid, p. 54.

example, assume that Q is a labour-intensive industry, and that the imported input, x, is 'biased' in that it is a much closer substitute for ℓ than for k. Now if the price of x goes up because of an input tariff, labour will be substituted for x because labour is a closer substitute for it than capital. At a given ratio of primary factor prices, this industry will raise its L/K ratio. But now what if labour is scarce relative to capital in the economy as a whole. So the size of the labour-intensive industry must contract, while that of a capital-intensive industry using x would expand. Jones gives an excellent mathematical interpretation of the necessary and sufficient conditions for a decrease in output caused by biased substitution effects.[18] Jones' general conclusion is that if protection is conferred primarily by a large increase in the output tariff, accompanied by a sufficiently small increase in the input tariff, the relative output of the protected commodity will rise.

This now brings the topic around to the protective effect, that is, the change in output of the industry granted some rate of effective protection. This is the subject of the next chapter.

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[18] Jones, R. W., "Effective Protection and Substitution", Journal of International Economics, 1, pp. 59-81. The model formulated by Jones for partial equilibrium was extended to general equilibrium by Batra, R. N., and Case, F. R., "Traded and Nontraded Inputs, Effective Protection, and Real Wages", Mimeo: June, 1971.

Chapter III

THE PROTECTIVE EFFECT AND PROFIT-MAXIMIZATION

3.1 The Protective Effect

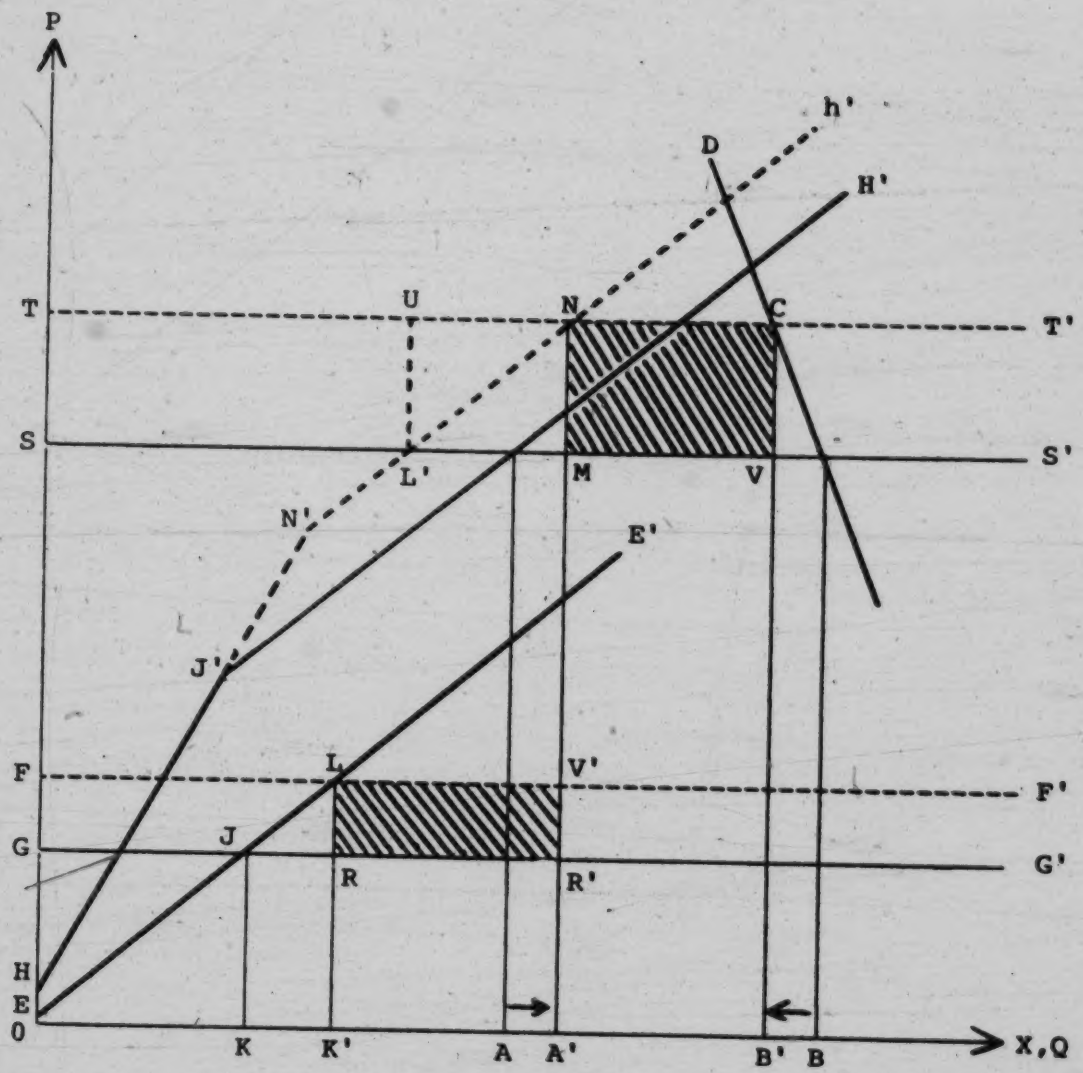
If the effective rate has in any way been shown to be measured satisfactorily, it must still be obvious that this rate of protection is not the sole determinant of the increase in domestic production, which is the protective effect that results from the tariff or subsidy. The higher the elasticity of supply of the domestic output the higher the protective effect of a given rate of protection. If the elasticity were zero there would be no supply effect irrespective of how high the protective rate was. It is also possible that there is no domestic supply at the world price P_o, but production starts at some higher price $P_o(1+t^*)$. The supply response is then zero up to a certain price so that a tariff somewhat lower than t^* would not have any production effect.

The model used will consist of one (importable) final good, Q, produced by one (importable) produced input, X, and one primary factor, L. All production functions exhibit constant returns to scale, and the prices of the final good and the inputs are determined competitively so that the factor prices are equal to their marginal products. The (importable) input has perfectly elastic supply at the world price P_o. The supply of the primary factor is less than

perfectly elastic so that its price varies with the amounts demanded. Further, assume that trade continues after the imposition of the tariff structure and that the domestic price is given by the world price plus the tariff.

It is possible to give some geometric precision to the analysis. Because of the extreme complexity in the diagram which would be necessitated when substitution is introduced, the diagram will be given for the case when the elasticity of substitution is zero. Quantities of both Q and X are shown along the horizontal axis; the units being chosen so that one unit of X is required by domestic producers to make one unit of Q, as indicated by the fixed input coefficient derived from their production function. In Figure 2, OG and OS are the free trade prices of X and Q respectively. The foreign supply curve of X is the horizontal line GG' and that of Q is SS'. The domestic demand curve for Q is DD' and domestic consumption is OB. The domestic supply curve of Q, HJ'H', is the vertical addition of the supply curve of X facing domestic producers and the supply curve of labour. It is assumed that domestic production is consumed before imports are purchased. In the absence of a tariff on X any extra X beyond OK will be obtained from imports, not from extra domestic production. Thus the supply curve of X facing domestic producers is EJG' with a kink at J. This yields a domestic supply curve of HJ'H'. The important thing to remember is that the supply of labour depends not on the nominal price of Q, but rather

Figure 2



Supply and Demand Curves

for an Importable Product

on the 'effective price', which is literally the price of labour, w.

Now introduce tariffs into the analysis. First an ad valorem tariff of GF/OG is placed on the production of X. Domestic output of X is increased by KK', the production effect. Assuming that t > m domestic production of Q will increase so that there is no decrease in the consumption of X. The assumption that trade continues after the imposition of a tariff assures that X will continue to be perfectly elastic at price OF. There is a revenue effect in that customs revenue is raised by the amount RLV'R', the tariff multiplied by the amount of imports demanded by the industry producing Q. There is a balance of payments effect in that the amount of imports have changed. There is a redistribution effect in that the price to the domestic producers has risen at the expense of domestic consumers.

A tariff of ST/OS>GF/OG, i.e., t > m, is placed on Q. The tariff on the input X has shifted the domestic supply curve up. Domestic production rises by AA'. There is a consumption effect of BB', and a balance of payments effect equal to the sum of AA' and BB'. Customs revenue has risen by MNCV. Finally there is a redistribution of income from consumers to producers equal to STNL'.

The higher the elasticity of substitution between X and L, the larger will be the output change associated

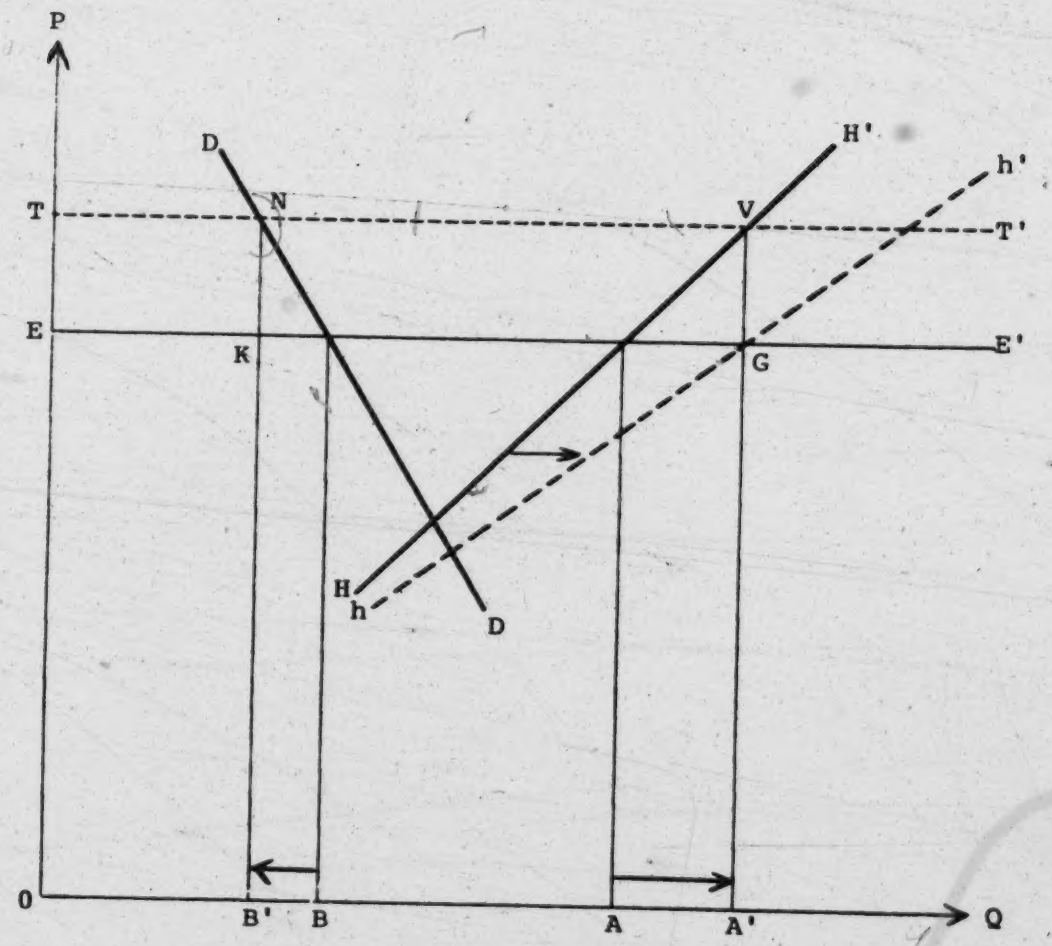
with an increase in the output tariff. Now assume that the elasticity of supply for the imported input, X, is less than infinite. Then, an increase in the demand for X implies an increase in its price and therefore in its marginal product. Barring the possibility of factor-intensity reversals between X and L again means a greater increase in production due to the imposition of an output tariff.

It is possible that the purpose of a tariff is to improve the balance-of-payments situation. Then the effect of a tariff in reducing imports will depend not only on the elasticity of supply for Q, but also on the domestic demand elasticity. The larger are these two elasticities, the larger will be the effect of a tariff, t. Up to this point it has been assumed that trade continues to take place after the imposition of the tariff structure. Then the limit on the tariff (t) will be that tariff which completely prohibits imports.

The previous analysis has taken place under the assumption that the industry in question is an import-competing one. The assumption of constant returns to scale and perfectly competitive product and factor markets will continue to be in effect. However, now assume that the industry producing Q is an export-competing one. The domestic producer now faces an imperfectly elastic domestic demand curve as well as an export demand curve that is perfectly elastic at the world price, P_o. Assume an export

subsidy is always accompanied by an appropriate tariff sufficient to ensure the whole domestic market to domestic producers of exportables and to prevent re-entry of exports for home consumption. An export subsidy raises the internal price of an exportable and from this point of view is equivalent to a tariff. This may be seen more easily by viewing Figure 3. An export subsidy of ET/OT is placed on Q, and an equivalent tariff to insure that OT is the domestic price facing consumers is invoked. Then domestic consumption now falls by BB', the actual amount depending on the elasticity of the demand curve. At the same time production increases from A to A', the actual amount depending on the elasticity of supply for Q. The export subsidy, therefore, has a production effect of raising production to OA' and a consumption effect of reducing consumption to OB'. In addition there is a two-pronged export effect raising exports to B'A'. The revenue effect is negative and equal to KNVG. There is a redistribution effect to producers of ETNK. An export tax has the same effect as an import subsidy and will therefore be anti-protective. However, if the input X is an exportable good, then an export tax on X would have the same effect as a production subsidy to the industry using it, it that it would have lowered costs of production for Q. By realizing the relationship between tariffs and subsidies, one can analyze the effective rate similarly to the case where the domestic industry is import-competing.

Figure 3



Supply and Demand Curves for an Exportable Product

3.2 Profit-Maximization

In the last chapter it was noted that Kreinin, et al. have devised a profit-maximization model: "While the consumer reacts to price changes on the final product (and is therefore affected by nominal and not by effective protection), the producer's action is determined by the prices of both the final product and the inputs. This, however, is not equivalent to saying that the producer reacts to changes in value added. Rather, economic theory suggests that he would react to changes in profit."[1/] However, Kreinin's analysis is based upon the crucial assumption that there are decreasing returns to scale, while the previous analysis has rested upon the assumption of constant returns to scale.

When the case is one of an import-competing good, $Q_s = P^{\lambda}$, where λ is the elasticity of the supply curve. By substituting the equilibrium supply conditions into the equaltion for the CES production function the equilibrium derived demand for the quantities of X and L can be shown as:

$$L^d = nP^{\lambda}\ \delta_2{}^{\sigma} w^{-\sigma}\ (\delta_1{}^{\sigma} r^{1-\sigma} + \delta_2{}^{\sigma} w^{1-\sigma})^{\sigma/1-\sigma} \qquad (3.1)$$

$$X^d = nP^{\lambda}\ \delta_1{}^{\sigma} r^{-\sigma}\ (\delta_1{}^{\sigma} r^{1-\sigma} + \delta_2{}^{\sigma} w^{1-\sigma})^{\sigma/1-\sigma} \qquad (3.2)$$

where n is the number of firms engaged in production of Q. Because λ is positive for the supply curve $Q_s=[P_o(1+t)]^{\lambda}$:

[1/] Kreinin, et al., op. cit., p. 891.

$$\frac{dQ}{dt} = \lambda P_o^{\lambda}(1+t)^{\lambda-1}; \qquad (3.3)$$

that is, a tariff on output will lead to an increase in Q_s.

The identity $V = PQ_s - rX$ shows the relationship between value added and the value of the output and the (importable) input. Since profit is equal to zero under constant-returns to scale, $V = wL$. Since this is the case it must be that the effective rate of protection granted to value-added is the same as that granted to labour. From equation (3.1) let us define the demand for labour, once tariffs t and m are imposed as:

$$\frac{L'-L}{L} = g^*_{\ell} = \frac{L'}{L} - 1$$

$$= \frac{nP_o^{\lambda}(1+t)^{\lambda}\delta_2^{\sigma}w^{-\sigma}\left[\delta_1^{\sigma}r_o^{1-\sigma}(1+m)^{1-\sigma}+\delta_2^{\sigma}w^{1-\sigma}\right]^{\sigma/1-\sigma}}{nP_o^{\lambda}\delta_2^{\sigma}w^{-\sigma}\left[\delta_1^{\sigma}r_o^{1-\sigma}+\delta_2^{\sigma}w^{1-\sigma}\right]^{\sigma/1-\sigma}} - 1$$

$$g^*_{\ell} = (1+t)^{\lambda}\ [h_o(1+m)^{1-\sigma} + (1-h_o)]^{\sigma/1-\sigma}$$

$$= (1+t)^{\lambda}\ (1+m)^{\sigma}\ b^{-\sigma/1-\sigma} \qquad (3.4)$$

where

$$b = \frac{(1+m)^{1-\sigma}}{(1+m)^{1-\sigma}h_o + (1-h_o)}$$

as before. When the industry producing Q is export-competing, t is replaced by an applicable export subsidy. Domestic consumption decreases but total production will increase if t>m.

Now allow for decreasing returns to scale: "... assume that the marginal cost curves are identical and that the production functions of the n firms are identical and that the production functions have decreasing returns to scale in the variable inputs so that the optimal size of the firm as well as the number of firms is determined."[2/] The production function becomes:

$$q = (\delta_1 x^{-\rho} + \delta_2 \ell^{-\rho})^{-s/\rho} \tag{3.5}$$

where s is the scale parameter, $0<s<1$, by definition. The equilibrium supply of Q becomes[3/]

$$Q_s = ns^{1/1-s}\, p^{s/1-s} (\delta^{\sigma}_1 r^{1-\sigma} + \delta^{\sigma}_2 w^{1-\sigma})^{-(s/1-s)/1-\sigma} \tag{3.6}$$

Now a change in the output of Q can be determined by finding Q'_s, the equilibrium output after the imposition of tariffs.

[2/] Kreinin, et al., op. cit., p. 892.

[3/] Ibid., p. 892.

It is then possible to derive a formula for the effective rate of protection granted to output. The formula will become:[4/]

$$g_q = \frac{Q'_s}{Q_s} - 1 = \left[\frac{1+t}{1+m}\right]^{s/1-s} b^{(s/1-s)/1-\sigma} - 1 \qquad (3.7)$$

where g_q is the rate of protection granted to output by the tariff structure, h_o is the share of the imported input in the total cost of production, and b is defined as before. It was found that the measurement of the effective rate of protection overestimates the amount of protection relative to g_q, and that the divergence between these two measures increases with σ and t. Yet, this is to be expected. Kreinin has correctly seen that in order to properly calculate the change in output caused by a change in the tariff structure it is necessary to start with the profit-maximizing process of the firm. What the Kreinin article does not seem to realize is that it is recognized that the protective rate does not predict output changes. Kreinin has attacked the effective rate as being an inadequate measure of the protective effect, which is true. But then the effective rate is not meant to measure the protective effect, because for the protective effect it is necessary to have the supply conditions for both the inputs and the final product.

[4/] Kreinin, et al., op. cit., p. 898.

Whether it is better to use decreasing or constant returns in the model is questionable. While most countries might be expected to have constant-returns to scale for the economy as a whole, it is not necessarily the case for individual industries. Obviously a great deal of work will have to be done on production functions before this question can be properly answered.

Chapter IV

POLICY IMPLICATIONS

The theory of effective protection has added new dimensions to tariff theory, bridging gaps where the use of nominal tariffs has proved inadequate. In addition, the concept of the 'protective effect' is another extension toward better analysis of international trade. However, this does not necessarily mean that we are suddenly presented with a true picture of the real world: "... the discovery of input tariffs does not mean the discovery of any heretofore hidden costs due to tariffs. Rather, we are better able to disentangle the distribution of these cost increases permitted by the nominal tariff."[1/] Further, there is the need to properly differentiate between import-competing and exporting industries in order to properly analyze the effects of a change in the tariff structure. This need will be illustrated when we discuss the policy implications of a possible change in the tariff structure later in this chapter.

One of the most important reasons for the calculation of the effective rather than the nominal tariff rates is that only the effective rates provide some information

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1/ Leith, J. C., "The Effect of Tariffs on Production, Consumption and Trade: A Revised Analysis", AER, March 1971, pp. 74-81.

about the direction and magnitude of primary resource movements. Most writers agree that in order to properly use effective rates as an indicator for resource movements, these rates must be considered in a general equilibrium context. Leith (1971), however, disagrees: "In a general equilibrium model neither the price nor the per unit value added definition of the effective rate of protection is an indicator of resource pull. The value added definition in a general equilibrium model suffers from the same problem arising from substitution as in the partial equilibrium model. The price definition has no meaning in a general equilibrium context because domestic factor prices are identical between all activities, with and without protection, and hence the proportionate changes in the factor prices are identical between all activities".[2/] Note at this point there is question as to the reliability of the effective rate of protection; however, as it was shown in the last chapter, it is the protective effect which actually states how and by what magnitude an industry's output will change in response to a change in the tariff structure.

It is not enough to merely talk about the effective rate or even the protective effect. It is necessary to break down and analyze the different components of these two concepts in order to fully understand them, and, therefore,

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2/ Leith, J. C., (1971), AER, p. 78.

put them to use as analytical tools. This we will attempt to do in the remainder of this chapter.

4.1 Import-Competing Industries

The purpose of a tariff is to protect domestic industry. Reasons as to why domestic industries must be protected are not always clear; it may be the "infant-industry" argument, protection of the domestic labour force, maintenance of the "status quo", or compensation for the inefficiency of the domestic industry. If the reasoning for the imposition of the tariff is indeed to compensate for the relatively less efficient domestic industry, then this may result in a "vicious circle" type of result. When the resultant tariff increase is sufficiently high, the domestic industry is protected to the point where it is unnecessary to improve efficiency in order to compete with imports. However, conceivably it is necessary for efficiency to improve in order for the industry to expand and develop. Melvin and Wilkinson have noted this problem: "..., Canadian effective tariffs, as high as they may appear at first glance, have not been sufficient to offset the lower Canadian efficiency as well as any increase in returns to labour in the United States that have been permitted there by reason of the American tariff structure."[3/]

3/ Melvin, J. R., and Wilkinson, B. W., Effective Protection in the Canadian Economy, Special Study No. 9, Economic Council of Canada, Queen's Printer, Ottawa, 1968, p. 54.

A question remains as to who pays for the tariff. Perhaps it is not really a question because as we saw in the last chapter there is a redistribution effect from the consumer to the producer as a result of the higher cost of the product and from the consumer to the government because the consumer must eventually pay for the customs revenue collected by the government. Even the tariff on the intermediate inputs is eventually passed on to the consumer because of higher production costs. True, under the model we have been using all benefits from the effective rate of protection are passed on to domestic labour in the form of higher wages, but also, under the model we are using the wage rate is determined by the supply curve for labour. The demand for labour in turn is dependent upon the output of the industry, which has been shown to be not solely dependent upon the effective rate of protection. Much has been written about the theory of effective protection, but in comparison relatively little has been written about how this theory may be implemented to further economic development. The following analysis is carried out in a partial equilibrium framework utilizing crude assumptions and is only one of several possible policy implications.

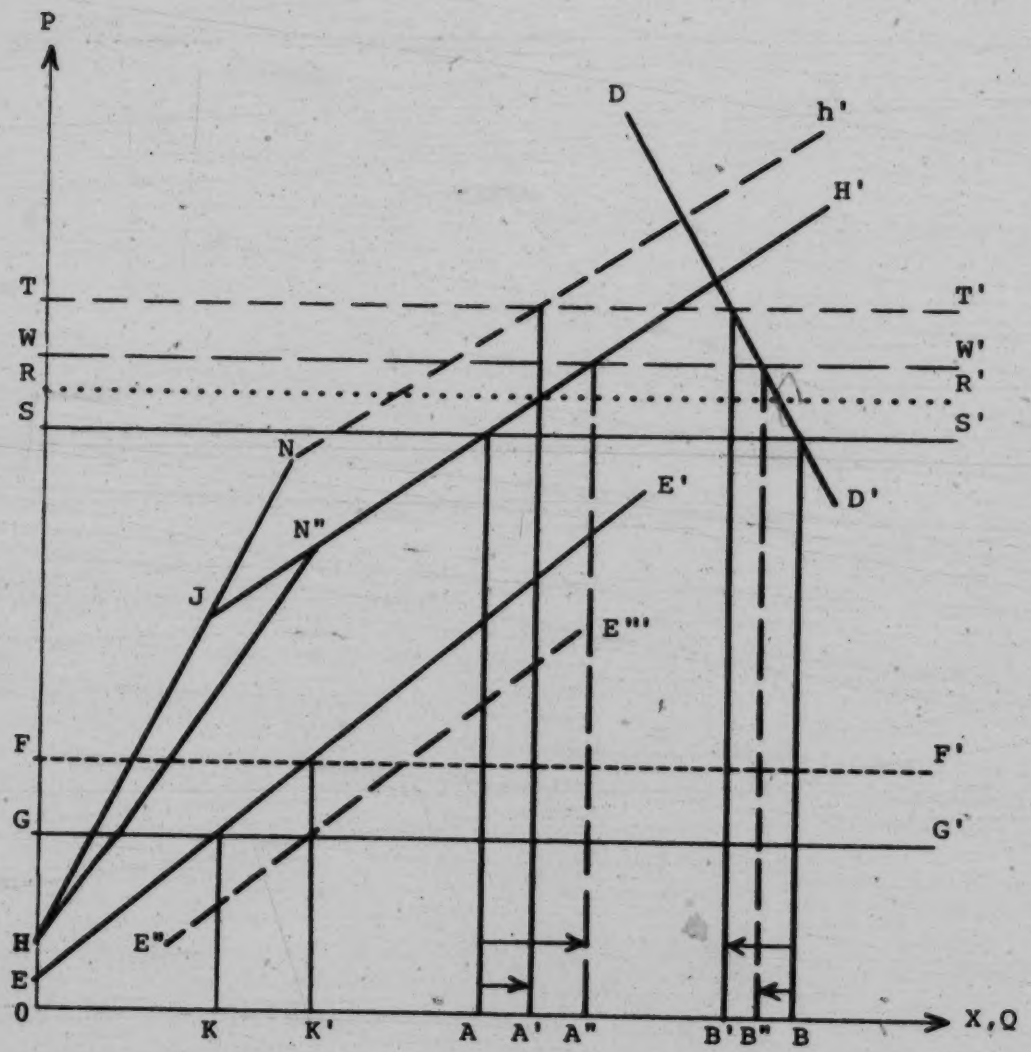
If it is desired to increase the competitiveness of Canadian industry by taking advantage of economies of scale, then output must be increased. It would be advantageous to do this without raising tariffs and therefore

prices. In fact, lowering tariffs has often been touted as a means to improve the competitiveness of Canadian industries by forcing resources to flow to the efficient firms from the relatively less efficient ones. Viewing the analysis from a partial equilibrium standpoint, this may be done by a tariff reduction to the (import-competing) industry producing the final good, accompanied by a subsidy to the (import-competing) industry producing the intermediate input.

In order to simplify the following geometrical analysis, we shall make the assumption of fixed input coefficients. The protective effect, the change in output made possible by a change in the tariff structure, is given by AA' in Figure 4, for the final product, Q. However, it is possible to view the results, if instead of a tariff a subsidy had been given to the industry producing the intermediate input, X. These results may be viewed in Figure 4.

Allow a subsidy equal to GF/OF for the production of the intermediate input, X; at the same time removing the tariff on X. This will cause the supply curve for X to shift down to E"E"', and production will continue to take place at OK'; the domestic price of X now being equal to the world price of OG. Since X is now available at a lower domestic price it will mean lower production costs for the industry producing Q. Therefore, the supply curve for Q

Figure 4



Supply and Demand Curves with a Subsidy

to the Intermediate Input

will now be traced out by HN"H". To maintain the same protective effect for the industry producing Q will require a tariff of only SR/OS (<ST/OS). Further consider if the tariff had only been reduced to some point W (SR/OS<SW/OS <ST/OS). In this case there would not only have been an increased output of Q, at a lower price to the consumer than in the original situation, but there would also be a customs revenue offsetting part of the cost of the subsidy.

It may thus be seen that merely looking at effective rates of protection does not tell the entire story of the effects to the economy. It would be possible to have equal effective rates of protection, indeed to the same industry, which would have a drastically different protective effect. In the one case we are levying tariffs on both the intermediate and the final goods, and this represents an increased cost to the consumer as well as inefficiently aiding the domestic industry. In the second case we are levying only one tariff, and even this may not be necessary if the intermediate input plays an important role in the production of the final good. The benefits of using the second strategy are many. Firstly, we are lowering domestic price thus benefiting the consumer. Secondly, since the tariff structure is now lower, Canada will be in a better international trading position, and better able to adjust to a "free trade" situation, should this eventually come about. Thirdly, it has been shown that short of an

entire abolition of the tariff structure, it would theoretically be possible to have a unilateral reduction in certain tariffs and still achieve an increased production in domestic import-competing industries.

Note that if the elasticity were higher, the effective rate of protection would also be higher (as shown in Table 1, Chapter 3). Therefore a subsidy to the industry producing the intermediate input X would serve to decrease production costs even further. However, even with a high elasticity of substitution total labour used would not necessarily decrease because of the ensuing increase in output of Q.

4.2 Export-Competing Industries

The final product of an export-competing industry is subject to a foreign tariff. However, the industry producing the intermediate input may be import-competing and therefore subject to a domestic tariff. It would be possible to give a subsidy to the industry producing the intermediate input, and thereby lower the costs to the export-competing industry producing the final output, the analysis being similar to that in the case of the final product being produced by an import-competing industry.

Although in theory it is possible to give an export-competing industry a subsidy coupled with a tariff to ensure that exports will not re-enter the country (see

Chapter 3, pp.36-37) it is not always feasible to do so. Under Gatt agreements it would not be allowed for an industry to sell at a lower price internationally than in the domestic market; that is, export subsidies are not permitted where they may constitute "dumping" in a foreign market. However, the granting of a subsidy would lower both the export price and the domestic price because if the export-competing industry was originally selling at the international price then this indirect subsidy would now cause both domestic and export prices to be less than the international price. The lower price constitutes a de facto barrier to imports, and gives exports an advantage in the world market.

The fact that export-competing industries are subject to the foreign tariff again exemplifies the need to properly define the theory of effective protection. It would not be possible to predict a flow of resources based solely on the domestic tariff structure because we would not be aware of the barriers facing the export-competing industries. This problem will be discussed further in the next chapter.

Chapter V

CONCLUSIONS

This study has shown that the effective rate of protection is not an accurate measure of the protective effect of a change in the tariff structure, where the protective effect is defined as being the accompanying change in output. Yet the question still remains: What is a change in the tariff structure meant to accomplish? If there is a large degree of unemployment in the country, as might well be the case with many developing countries, then the effective rate will correctly predict the protection granted to labour. If the objective is to increase output, then it is necessary to know the production function and the supply conditions for both labour and the (importable) intermediate good. If the objective is to decrease imports of the (importable) final good, it is also necessary to know the domestic demand conditions.

The analysis has been developed along the assumption that X is an (importable) intermediate good. However, the actual characteristics of X were never discussed, and this will be important in noting the degree of substitution between L and X. If X is a raw material or some manufactured material input then substitution will likely be low. However, if X is a capital good it is possible that it could be highly substitutable for labour, especially in the manufacturing sectors. This will have obvious significance for

those countries where the elasticity of substitution is very high. It may not be possible to place a high enough tariff on output to make the effective rate positive. At this point, it will be necessary to subsidize the domestic industry to ensure its existence. If the industry to be granted protection is a primary one then the elasticity of substitution is likely to be very low, and Leontief-type production functions will be the case. However, if it is a manufacturing industry, then we would expect the production function to be of the CES type. Further, consider the case where the inputs are not substitutes, but rather are complements. This will certainly be the case if the good is produced under a constant technology so that substitution is at best limited.

Throughout this thesis, we have used a model which allows for only one primary factor of production, namely labour. This is equivalent to making the assumption that capital is perfectly mobile internationally. This assumption is obviously somewhat unrealistic. It is not, however, that unrealistic in a case such as Canada's where capital imports make up such a large proportion of our imports. In Canada's case what is an unrealistic assumption is to exclude natural resources. Recent work has shown Canada's exports to be extremely natural resource intensive relative

to her imports.[1/] This finding also holds true for manufacturing and secondary manufacturing trade for most of Canada's trading partners. In addition, the greater the natural resource intensity the greater the capital intensity of exports relative to imports. Thus, we may see some evidence of complementarity of inputs.

The theory of effective protection has been developed with the hope that the results it shows would help predict resource movements. However, in order to study resource movements, it will be necessary to move to a general equilibrium model. According to the Stolper-Samuelson theory[2/] the relative wage of a factor used intensively in an industry will rise, and so will its real wage. It has been shown that effective protection always raises the relative reward of the factor used intensively. However, it has not been shown that effective protection necessarily raises the real wage of the relevant factor in relation to the wage in other industries. Obviously it is necessary to extend the analysis to a general equilibrium framework in order to do this.

If Canada is to improve her international trading

1/ Based on preliminary work done on a study of the factor-content of Canada's international trade by H. Postner and D. Gilfix for the Economic Council of Canada (forthcoming).

2/ Stolper, W., and Samuelson, P. A., "Protection and Real Wages", Review of Economic Studies (November, 1941).

position and at the same time improve domestic conditions with regard to inflation and unemployment then the place to begin is with the import-competing industries. It was shown in the previous chapter that it is possible to take advantage of the linkage effects in domestic industry to increase production by manipulation of the tariff structure. If Canadian industry is indeed relatively labour intensive in the import-competing industries, especially the secondary manufacturing ones, then it is beneficial to develop these industries so as to make them more competitive. The use of analytic tools provided by the theories of effective protection and the protective effect are but one step. A great deal more work must be done in the fields of non-tariff barriers and quantifications of elasticities of supply, demand, and substitution to take full advantage of these linkage effects.

The use of partial equilibrium analysis may present a distorted picture of the true situation. Partial equilibrium analysis suggests that the degree of protection will be lower, the lower the foreign elasticity of supply. If this were to be zero then a rise in the tariff will lead to a fall in the foreign price equal to the tariff so that there would be no rise in domestic price and hence no protective effect. However, it also suggests that this term of trade effect, while it modifies and may possibly even eliminate this protective effect, cannot possibly reverse

it. But in the general equilibrium model the terms of trade can reverse the protective effect. This is the Metzler paradox.[3/] A tariff is imposed so that there is positive nominal and effective protection and the balance of payments is improved. An exchange rate appreciation is then necessary to restore external balance. If the elasticity of demand is less than unity this will mean that the appreciation will actually raise the value of exports in terms of foreign currency. Since the value of exports is raised, the exporting country will again be left with a balance of payments surplus, thus necessitating still further currency appreciation. Finally, both the value of the exports and the imports will be higher than in the free trade situation and the domestic price of the importable will be lower. So the ordinary effective rate is positive but the 'net' effective rate, which takes into account the large exchange rate adjustment could actually be negative.

There is much work to be done in tariff theory. The analysis should be carried out in a general equilibrium framework so that the full potential effects of the tariff will be viewed. However, one has to realize the potential difficulty in applying the would-be conclusions to empirically meaningful propositions in a general equilibrium world. But even before this analysis can be carried out

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3/ Metzler, L. A., "Tariffs, the Terms of Trade and the Distribution of National Income", JPE, 57, February 1949, pp. 1-29.

there is a far more basic question to be answered in what the desired effect of a change in the tariff structure is to be. Only when this question is answered can a fully adequate analysis be developed.

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